THE ADEQUACY OF DIGITAL TEACHING RESOURCES, TEACHERS' TECHNOLOGY ACCEPTANCE, AND CLASSROOM TEACHING QUALITY AT HENGXING UNIVERSITY

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ABSTRACT

This research aimed to examine the association between the adequacy of digital teaching resources, teachers' technology acceptance, and classroom teaching quality at Hengxing University. The sample consisted of 350 full-time teachers, selected through a stratified random sampling method from a population of approximately 1,400 teachers. A structured questionnaire comprising 45 measurement items was administered, and descriptive statistics, confirmatory factor analysis, and structural equation modeling were employed. Regression analyses indicated that the adequacy of digital teaching resources was strongly associated with classroom teaching quality ($b = 0.945$, $p < .001$, $R^2 = 0.899$), and teachers' technology acceptance was also strongly associated with classroom teaching quality ($b = 0.934$, $p < .001$, $R^2 = 0.878$). When entered jointly, the two predictors explained 91.9% of the variance ($R^2 = 0.919$). However, discriminant validity was not established (inter-construct correlations = 0.93-0.95, exceeding the square root of AVE ≈ 0.71), and the latent-variable structural equation model produced an unstable, non-significant path estimate for resource adequacy ($b = -3.18$, $p = .865$). These findings indicate that the three constructs could not be empirically distinguished in the present data, likely reflecting common method variance or a general positive-evaluation tendency. The regression results should therefore be interpreted as evidence of strong co-variation rather than separable effects. Practical recommendations are offered with explicit caveats regarding the measurement limitations.

Keywords: Digital Resources, Technology Acceptance, Teaching Quality, Discriminant Validity

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INTRODUCTION

Digital transformation has become an important part of contemporary higher education, changing how teachers select learning materials, organize classroom activities, communicate with students, assess learning, and provide feedback. Universities increasingly rely on learning management systems, digital libraries, online assessment platforms, cloud services, multimedia resources, and other educational technologies. However, the educational value of these technologies depends not only on their availability but also on whether teachers can access, select, and use them effectively in actual teaching. Previous research has also shown that university teachers' digital competence and their ability to integrate technology into pedagogy are important conditions for effective digital teaching (Saltos-Rivas et al., 2023; Fernandez-Morante et al., 2023).

In this study, the adequacy of digital teaching resources refers to the extent to which available digital materials, platforms, tools, and related support are sufficient for teachers' instructional needs. It is examined through three dimensions: resource accessibility, resource appropriateness, and resource usability. Accessibility concerns whether teachers can conveniently obtain and use required digital resources; appropriateness refers to the alignment of resources with course objectives, curriculum content, student characteristics, and learning outcomes; and usability concerns the ease with which teachers can operate, adapt, and integrate resources into teaching (Alberola-Mulet et al., 2021).

Teachers' technology acceptance represents another important factor influencing the effective use of digital resources. Based on the Technology Acceptance Model (TAM) proposed by Davis (1989), technology acceptance is represented by perceived usefulness, perceived ease of use, and usage attitude and intention. Previous studies have shown that perceived usefulness and perceived ease of use are important determinants of teachers' attitudes and intentions toward educational technology, indicating that technology availability alone does not guarantee meaningful classroom integration (Fauzi et al., 2021; Rui et al., 2023).

Classroom teaching quality is the dependent variable of the study and refers to the quality of instructional processes through which teachers organize objectives, content, learning activities, interaction, assessment, and feedback. It is measured through teaching design and organization, student participation and classroom interaction, and learning assessment and feedback. This approach is consistent with learner-centered teaching and constructive alignment (Cooper et al., 2025; Archambault et al., 2022).

Despite the increasing use of digital technologies in higher education, several issues remain. Universities may invest substantially in digital resources without knowing whether teachers consider them sufficiently accessible, appropriate, and usable for actual classroom teaching. Teachers may also differ in their acceptance of technology even when they work within the same digital environment (Choi & Seo, 2024). In addition, many previous studies have concentrated on technology adoption or digital competence without directly examining how these factors relate to classroom teaching quality (Vlachopoulos & Makri, 2021). Therefore, the present study examines the association between the adequacy of digital teaching resources, teachers' technology acceptance, and classroom teaching quality at Hengxing University.

The study is significant because it provides both theoretical and practical value. Theoretically, it extends the application of the Technology Acceptance Model by linking teachers‘ technology acceptance to classroom teaching quality while simultaneously incorporating the adequacy of digital teaching resources as an environmental factor (Otto et al., 2024). Practically, the findings can support university decisions concerning digital resource planning, teacher professional development, and teaching-quality improvement, subject to the measurement limitations reported in this study.

LITERATURE REVIEWS

Relationship between Adequacy of Digital Teaching Resources and Classroom Teaching Quality

Digital teaching resources are electronically accessible materials, tools, platforms, services, and learning-support objects that teachers can use to plan, deliver, manage, assess, and improve teaching (Fernandez-Morante et al., 2023). They include digital textbooks, lecture slides, videos, simulations, databases, open educational resources, learning management systems, and multimedia content. In higher education, digital resources can support both direct classroom teaching and learning activities that occur before or after class (Saltos-Rivas et al., 2023). The concept should be distinguished from digital technology in general: a network or a learning management system is infrastructure, whereas a digital teaching resource is educational content or a usable digital means that supports a specific teaching purpose (Alberola-Mulet et al., 2021).

Resource adequacy is a sufficiency concept. It means that the resources available are sufficient to support the tasks teachers are expected to perform (Saha et al., 2022). In this study, resource adequacy is conceptualized through three dimensions. Resource accessibility concerns whether resources can be reached when required; resource appropriateness concerns whether the content and functions match instructional needs; and resource usability concerns whether teachers can operate and integrate the resources with reasonable effort (Alberola-Mulet et al., 2021). These dimensions reflect a logical progression from “Can I access it?” to “Is it suitable?” and finally “Can I use it effectively?”

Biggs‘ (1996) constructive alignment framework provides an important theoretical lens. Constructive alignment links learning outcomes, teaching and learning activities, and assessment, implying that teachers should select digital resources according to pedagogical purpose rather than use them simply because they are technologically available (Runge et al., 2023). When teachers have accessible, appropriate, and usable resources, they have greater capacity to design varied activities, organize content, facilitate interaction, and implement assessment and feedback (Runge et al., 2023). The relationship is therefore expected to operate through teachers’ instructional choices: higher perceived adequacy is positively associated with higher perceived classroom teaching quality (Saltos-Rivas et al., 2023). Accordingly, the following hypothesis was derived:

H1: The adequacy of digital teaching resources is positively associated with classroom teaching quality at Hengxing University.

Relationship between Teachers‘ Technology Acceptance and Classroom Teaching Quality

The Technology Acceptance Model was developed by Fred D. Davis to explain why individuals accept or reject information technology (Davis, 1989). Davis identified perceived usefulness and perceived ease of use as fundamental determinants of user acceptance, and subsequent research has consistently demonstrated their importance in explaining teachers' acceptance of educational technology (Saha et al., 2022; Cabero-Almenara et al., 2024). TAM is particularly relevant to education because teachers are not passive recipients of digital systems; they make decisions about whether, how often, and for what purpose technologies will be used (Saha et al., 2022).

Perceived usefulness refers to the degree to which an individual believes that using a system will improve job performance. In a teaching context, usefulness can include improving lesson organization, saving preparation time, increasing access to teaching materials, facilitating interaction, supporting assessment, or helping students understand content (Saha et al., 2022). Perceived ease of use refers to the extent to which a person believes that using a system will require little effort (Davis, 1989). The present study combines teachers‘ usage attitude and intention as the third operational dimension, capturing the motivational side of technology integration (Cabero-Almenara et al., 2024).

Technology acceptance should not be equated with digital competence. Digital competence concerns what a teacher knows and can do with technology, whereas acceptance concerns beliefs, attitudes, and willingness to use technology (Saltos-Rivas et al., 2023). The proposed relationship between technology acceptance and teaching quality is based on the assumption that accepted technologies are more likely to be integrated into teaching in purposeful and sustained ways. Perceived usefulness can encourage teachers to use digital tools for instructional design, interaction, and assessment; perceived ease of use can reduce operational barriers; and positive attitudes and intentions can support continued experimentation and use (Runge et al., 2023). Recent research directly connects teachers' digital-competence-related beliefs with instructional quality, providing a conceptual bridge between technology acceptance and classroom teaching quality (Runge et al., 2023). Accordingly, the following hypothesis was derived:

H2: Teachers' technology acceptance is positively associated with classroom teaching quality at Hengxing University.

Conceptual Framework

From the literature review, the conceptual framework of the present study is shown in Figure 1) The framework consists of two independent variables—the adequacy of digital teaching resources and teachers‘ technology acceptance—and one dependent variable, classroom teaching quality. H1 represents the proposed association between digital-resource adequacy and classroom teaching quality, and H2 represents the proposed association between technology acceptance and classroom teaching quality.

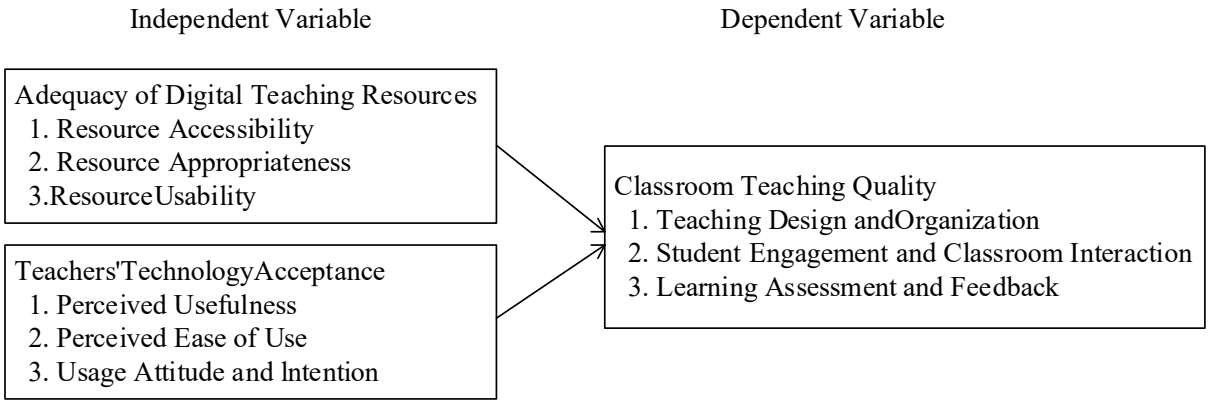


Figure 1 Conceptual Framework adapted from Scherer et al. (2019)

RESEARCH METHODOLOGY

Population and Sample

The accessible population consisted of approximately 1,400 full-time teachers at Hengxing University who held active teaching responsibilities. Using Taro Yamane‘s formula (Yamane, 1967) at a 95% confidence level and an allowable sampling error of 5%, the minimum required sample size was calculated as $n = N / (1 + Ne^2) = 1,400 / (1 + 1,400 \times 0.05^2) \approx 312$ teachers. Considering possible non-response, approximately 380 questionnaires were distributed, and 350 valid completed responses were obtained, exceeding the minimum requirement.

The sample was selected using a stratified random sampling method. The sampling frame was stratified by academic faculty (e.g., engineering, management, arts, education), and within each stratum, teachers were randomly selected using a random number generator proportional to the stratum size. This procedure ensures that the sample reflects the faculty composition of the university and justifies the use of Yamane’s formula, which assumes probability sampling.

Research Instrument

The research instrument was a structured questionnaire developed and adapted from relevant theories and validated measurement scales. The questionnaire consisted of four parts. Part 1 collected demographic information including gender, age, highest educational qualification, total teaching experience, and self-reported frequency of using digital teaching technologies. Part 2 measured teachers‘ perceived adequacy of digital teaching resources with 15 items covering resource accessibility (5 items), resource appropriateness (5 items), and resource usability (5 items). Part 3 measured teachers’ technology acceptance grounded in TAM with 15 items covering perceived usefulness (5 items), perceived ease of use (5 items), and usage attitude and intention (5 items). Part 4 measured teachers‘ self-perceived classroom teaching quality with 15 items covering teaching design and organization (5 items), student participation and classroom interaction (5 items), and learning assessment and feedback (5 items). Parts 2, 3, and 4 used a five-point Likert rating scale from 1 (strongly disagree) to 5 (strongly agree).

Before the instrument was applied, content validity was examined through the Index of Item-Objective Congruence (IOC) by three experts, and a pilot test was conducted to assess

internal-consistency reliability using Cronbach's alpha coefficient (Taherdoost, 2022). Since the survey was distributed to Chinese-speaking teachers, the questionnaire underwent translation and back-translation procedures to guarantee semantic consistency (Shrestha et al., 2020).

Data Collection

Primary data were collected from eligible full-time teachers at Hengxing University. Prior to formal data collection, the researcher obtained institutional research approval, and the questionnaire was distributed via electronic survey platforms following the stratified random sampling plan. Participants were informed of the research purpose, respondent eligibility, estimated completion time, voluntary participation, anonymity, and confidentiality before proceeding (Taherdoost, 2022). All 350 returned questionnaires were complete, with no missing values among the 45 measurement items.

Data Analysis

Survey data were processed and analyzed with statistical software. Demographic characteristics were analyzed using frequency and percentage. The levels of the three constructs and their dimensions were analyzed using mean and standard deviation. Confirmatory factor analysis (CFA) was employed to examine the measurement model, convergent validity, and discriminant validity. Three analytical specifications were used to examine the hypothesized associations: (a) single-predictor OLS regression on dimension composite scores; (b) joint OLS regression; and (c) second-order latent-variable structural equation modeling. All three specifications are reported in full, including the failure of specification (c), because the pattern of results across specifications is itself substantively informative.

RESEARCH RESULTS

Respondents' Profiles

Of the 350 respondents, 195 (55.71%) were female and 155 (44.29%) were male. Regarding age, the largest group was 36-45 years (132, 37.71%), followed by 26-35 years (123, 35.14%), 46 years or above (81, 23.14%), and 25 years or below (14, 4.0%). In terms of educational qualification, most respondents held a master's degree (203, 58.0%), followed by a doctoral degree (71, 20.29%) and a bachelor's degree (62, 17.71%). Regarding teaching experience, 152 respondents (43.43%) had 6-10 years, 107 (30.57%) had 11-20 years, 67 (19.14%) had 5 years or less, and 24 (6.86%) had more than 20 years. In terms of frequency of using digital technologies, 91 respondents (26.0%) reported "often," followed by 82 (23.43%) "sometimes," 73 (20.86%) "rarely," 67 (19.14%) "always," and 37 (10.57%) "never."

Descriptive Statistics of the Studied Variables

Table 1 displays the mean, standard deviation, skewness, kurtosis, and interpretation of the studied variables. All three constructs were rated at a "high" level: the adequacy of digital teaching resources (M = 3.561, SD = 0.923), teachers' technology acceptance (M = 3.539, SD = 0.923), and classroom teaching quality (M = 3.543, SD = 0.920). All nine dimensions fell within the "high" range (means between 3.51 and 3.57). Skewness values were negative and kurtosis values were close to zero.

Table 1 Mean, Standard Deviation, and Interpretation of the Studied Variables

Variable	N	Mean	SD	Skewness	Level
Resource Accessibility	350	3.565	0.981	−1.247	High
Resource Appropriateness	350	3.566	0.964	−1.302	High
Resource Usability	350	3.553	0.985	−1.300	High
Perceived Usefulness	350	3.554	0.997	−1.267	High
Perceived Ease of Use	350	3.515	0.978	−1.164	High
Usage Attitude and Intention	350	3.549	0.968	−1.219	High
Teaching Design and Organization	350	3.527	0.977	−1.279	High
Student Participation and Classroom Interaction	350	3.558	0.999	−1.254	High
Learning Assessment and Feedback	350	3.543	0.951	−1.222	High
Adequacy of Digital Teaching Resources	350	3.561	0.923	−1.585	High
Teachers' Technology Acceptance	350	3.539	0.923	−1.546	High
Classroom Teaching Quality	350	3.543	0.920	−1.570	High

Note. Construct scores are the means of their three dimension scores. Level is interpreted according to the mean interpretation criteria (3.41-4.20 = high).

Measurement Model, Convergent Validity, and Discriminant Validity

Confirmatory factor analysis was performed to evaluate the measurement model. The measurement model was specified as a second-order structure in which nine first-order latent variables (dimensions) were measured by their five items each and were further explained by three second-order latent variables (constructs). The fit indices for both the first-order and second-order models were acceptable: χ^2/df = 1.152 and 1.147, CFI = 0.986, TLI = 0.985, RMSEA = 0.021, SRMR = 0.027, GFI = 0.904/0.902, AGFI = 0.895/0.896, and NFI = 0.904/0.902.

The standardized factor loadings of all 45 items on their respective dimensions ranged from 0.658 to 0.769, all significant at $p < .001$) The composite reliability (CR) of the nine

dimensions ranged from 0.823 to 0.852, and the average variance extracted (AVE) ranged from 0.482 to 0.535) At the construct level, CR ranged from 0.937 to 0.941 and AVE ranged from 0.50 to 0.51.

Discriminant validity was not established. According to the Fornell-Larcker criterion, the square roots of AVE for the three constructs were approximately 0.71, whereas the inter-construct correlations were as high as 0.93-0.95) Dimension-level correlations ranged from 0.81 to 0.85) Because the inter-construct correlations exceeded the square roots of AVE, the three constructs could not be empirically distinguished. This result is a genuine characteristic of the data rather than a computational error, and it suggests a strong general factor reflecting common-method variance or an overall positive-evaluation tendency.

Hypothesis Analysis

To examine H1 and H2, three specifications were estimated and are reported in full in Table 2.

Table 2 Results across Three Analytical Specifications

Specification	**Path**	**b**	**t**	**p**	**R^2**	**Interpretation**
Single regression	Adeq → TQ	0.945	55.52	< .001	0.899	Strong bivariate association
Single regression	Acc → TQ	0.934	49.93	< .001	0.878	Strong bivariate association
Joint regression	Adeq → TQ	0.571	13.29	< .001	0.919	Coefficient attenuated by collinearity; not independently interpretable
Joint regression	Acc → TQ	0.400	9.31	< .001	0.919	Coefficient attenuated by collinearity; not independently interpretable
Latent SEM	Adeq → TQ	−3.18	−0.17	.865	—	Model unstable; not interpretable

Note. Adeq = adequacy of digital teaching resources; Acc = teachers‘ technology acceptance; TQ = classroom teaching quality. Single and joint regressions are based on dimension

composite scores; the latent-variable SEM is based on the second-order latent-variable model. VIF ≈ 7.9.

When examined separately, the adequacy of digital teaching resources was strongly and positively associated with classroom teaching quality ($b = 0.945$, $t = 55.52$, $p < .001$, $R^2 = 0.899$), and teachers' technology acceptance was strongly and positively associated with classroom teaching quality ($b = 0.934$, $t = 49.93$, $p < .001$, $R^2 = 0.878$). When both independent variables were entered jointly, they together explained 91.9% of the variance ($R^2 = 0.919$), and both coefficients remained statistically significant (adequacy: $b = 0.571$, $t = 13.29$, $p < .001$; acceptance: $b = 0.400$, $t = 9.31$, $p < .001$). However, the two independent variables were correlated at $r = 0.935$, yielding a VIF of approximately 7.9, which indicates severe multicollinearity. The individual coefficients in the joint model should therefore not be overinterpreted.

Critically, the latent-variable SEM did not converge to a stable solution. The path from resource adequacy to teaching quality was negative and non-significant ($b = -3.18$, $t = -0.17$, $p = .865$), and the two latent predictors were correlated at nearly 1) This failure is consistent with the discriminant validity results: when the constructs cannot be distinguished, the SEM cannot partition their effects. The regression results therefore indicate strong co-variation, not separable effects. H1 and H2 are directionally consistent with the data in the regression specifications, but the latent-variable specification does not support the claim that resource adequacy and technology acceptance exert independent associations with teaching quality.

DISCUSSION & CONCLUSION

The findings are summarized as follows. First, the adequacy of digital teaching resources was strongly and positively associated with classroom teaching quality in regression specifications. Second, teachers‘ technology acceptance was also strongly and positively associated with classroom teaching quality in regression specifications. Third, when both independent variables were considered together, they jointly explained approximately 92% of the variance. However, these associations must be interpreted in light of two critical measurement findings: discriminant validity was not established, and the latent-variable SEM produced an unstable and non-significant estimate. The three constructs could not be empirically separated in the present data.

The strong bivariate associations are consistent with previous research emphasizing that the educational value of digital resources depends substantially on how teachers perceive and integrate them into classroom practice (Alberola-Mulet et al., 2021). They also align with constructive alignment, which emphasizes that digital resources should be selected according to pedagogical purpose (Biggs, 1996), and with TAM-based research demonstrating that perceived usefulness and perceived ease of use are important correlates of teachers' orientation toward educational technology (Saha et al., 2022; Cabero-Almenara et al., 2024). Teachers who perceive technology as useful, manageable, and worth adopting may be more likely to integrate it into instructional design, interaction, and assessment.

However, an equally plausible interpretation is that the high correlations reflect common method variance rather than substantive relationships. All three constructs were measured

through teacher self-report within the same questionnaire, and the excellent CFA fit of a strongly correlated second-order model is consistent with a general factor dominating all 45 items. Under this interpretation, teachers who generally evaluate their working environment positively also report high resource adequacy, high technology acceptance, and high teaching quality, producing correlations that overstate the distinct associations among the constructs. The failure of the latent-variable SEM to produce a stable solution reinforces this concern: when constructs are indistinguishable, the model cannot estimate their separate contributions.

This study provides two main contributions. Theoretically, it extends the application of the Technology Acceptance Model by linking teachers‘ technology acceptance to classroom teaching quality while incorporating resource adequacy as an environmental factor (Otto et al., 2024). Methodologically, it provides a transparent demonstration of how discriminant validity failure and common method variance can produce inflated regression coefficients, and why latent-variable SEM may fail even when CFA fit indices appear acceptable. For managerial practice, the findings suggest that resource provision and teacher technology support co-vary within the same institutional context, reinforcing the need for a holistic approach to digitalization. The three dimensions of resource adequacy can help management distinguish access, content-fit, and usability issues, and the three dimensions of technology acceptance can help distinguish usefulness, complexity, and attitudinal concerns. These practical implications should be treated as provisional, given the measurement limitations.

Limitations. First, discriminant validity was not established ($\sqrt{AVE} \approx 0.71 < r = 0.93\text{-}0.95$), meaning the three constructs could not be empirically distinguished. Second, common method variance is a serious concern because all constructs were measured through teacher self-report within the same questionnaire. Third, multicollinearity (VIF ≈ 7.9) rendered the individual coefficients in the joint regression model uninterpretable. Fourth, the latent-variable SEM produced an unstable solution and cannot be used as evidence for the hypotheses. Fifth, although stratified random sampling was employed, the study was delimited to a single institution, which limits generalizability. Sixth, the cross-sectional design does not permit causal conclusions. Future research should separate data sources (e.g., collecting teaching quality data from student evaluations or classroom observations), use different scale formats or temporal separation to reduce common method variance, and validate the discriminant validity of the instrument before testing structural relationships.

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